UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,146	02/10/2004	Lawrence C. Gunn III	LUX-P020	3066

7590 03/21/2007

Fernandez & Associates, LLP
PO Box D
Menlo Park, CA 94026-6402

EXAMINER	
SONG, SARAH U	
ART UNIT	PAPER NUMBER
2874	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/21/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/776,146	GUNN ET AL.	
	Examiner	Art Unit	
	Sarah Song	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8-12,15-25,27,28,31-36,38-42,45-55 and 57-97* is/are pending in the application.

4a) Of the above claim(s) *57-97* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8-12,15-25,27,28,31,33-36,38-42,45-55 and 57-97* is/are rejected.

7)☒ Claim(s) *32* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's communication filed on December 20, 2006 has been carefully considered and placed of record in the file. Claims 8, 32, 38, 47, 48, 51 and 52 are amended. Claims 7, 13, 14, 26, 29, 30, 37, 43, 44 and 56 are canceled. Claims 1-6, 8-12, 15-25, 27, 28, 31-36, 38-42, 45-55 and 57-97 are pending. Claims 57-97 have been withdrawn from consideration.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. **Claims 1-6, 8-12, 15, 16, 19-25, 27, 28, 31, 33-36, 38-42 and 45-55 are rejected under 35 U.S.C. 102(b) as being anticipated by Schultz et al. (U.S. Patent 6,285,813 previously cited).**

4. Regarding claims 1, 19, 31 and 45, Schultz et al. discloses a waveguide grating coupler for coupling light between a waveguide and an optical element having a substantially Gaussian mode profile, said waveguide grating coupler, comprising:

a planar guiding portion 103 optically connected to said waveguide, said planar guiding portion having first and second ends and an optical power distribution therein that decreases between said first and second ends; and

a plurality of elongate scattering elements 113 having respective scatter cross-sections arranged along at least a portion of said planar guiding portion to couple light having a substantially Gaussian intensity distribution between said planar guiding portion

and said optical element, said elongate scattering elements having at least one characteristic which varies in magnitude among at least a group of said elongate scattering elements, said magnitude of said characteristic controlling at least in part said scatter cross-sections of said elongate scattering elements, wherein said magnitude of said characteristic of said group of elongate scattering elements varies irregularly, said magnitude for said group of elongate scattering elements changing with position along said planar guiding portion at a rate that is discontinuous, wherein said magnitude of said characteristic for said plurality of elongate scattering elements varies non-linearly with position along said planar guiding portion, and a plot of the magnitudes of said characteristic associated with said plurality of elongate scattering elements versus position along said guiding portion includes at least one elongate scattering element substantially offset from a single exponential or Gaussian that is fit to said plot, wherein said characteristic may include width (in direction of light propagation) controlling at least in part said scatter cross-sections of said elongate scattering elements as defined by a relationship between widths and scatter cross-sections, said relationship including at least two widths that provide substantially similar scatter cross-sections wherein said elongate scattering elements are relatively positioned to provide said substantially Gaussian intensity distribution of said coupled light and said decay of said optical power distribution in said coupler, and . See Figures 1A-2, 6, column 3, lines 33 through column 4, line 42.

5. Regarding claims 2, 20, 34 and 46, the optical element comprises an optical fiber (see Claims 39 and 52).

6. Regarding claims 3, 21 and 47, said magnitude of said characteristic changes with position along said planar grating portion so as to provide an optical output substantially matching said Gaussian mode profile of said optical element (column 6, lines 18-30).

7. Regarding claims 4, 5, 23, 33, 35 and 48, said rate of change in magnitude of said characteristic for said group of elongate scattering elements both increases and decreases between said first and second ends. That is, the non-monotonically varying relationship between said scatter cross-section and said magnitude has portions with negative slope and portions with positive slope. See Figure 5B.

8. Regarding claims 6, 25, 36 and 49, said planar guiding portion has sidewalls to confine light in a transverse direction. See Figure 1A.

9. Regarding claims 8, 38 and 51, said optical power distribution decreases between said first and second ends of said planar guiding portion substantially in accordance with a relationship as claimed.

10. Regarding claims 9, 27 and 39, said at least one characteristic is selected from the group consisting of grating width, grating height, grating spacing, grating depth, and index of refraction of said elongate scattering elements (column 3, lines 50-62; column 7, lines 19-37).

11. Regarding claims 10, 22, 40 and 52, the plot of the magnitudes of said characteristic associated with said group of elongate scattering elements versus position along said guiding portion includes more than two elongate scattering elements substantially offset from a single exponential or Gaussian function that is fit to said plot.

12. Regarding claims 11, 24, 41 and 53, the plurality of elongate scattering elements comprises at least 20 elongate scattering elements.

13. Regarding claims 12, 28, 42 and 54, it appears that said magnitude of said characteristic at different positions along said planar grating is selected such that the variation F(z) in scatter cross-sections of the group of elongate scattering elements as a function of longitudinal distance across the group of elongate scattering elements satisfies the following relationship: G(z) = F(z) E(z) where G(z) corresponds to said substantially Gaussian mode profile of said optical element, and E(z) corresponds to optical power distribution that decreases between said first and second ends.

14. Regarding claims 15 and 16, the waveguide grating coupler further comprises a substrate 121, said planar guiding portion 103 being disposed over said substrate.

1. Regarding claim 50, the planar guiding portion is selected from the group consisting of a channel waveguide, a ridge waveguide, a strip loaded waveguide, and a strip loaded waveguide having a low index transition region.

15. Regarding claim 55, said waveguide grating coupler couples a substantially planar wave between said waveguide and said optical element, said substantially planar wave oriented at an angle with respect to said planar guiding portion, said elongate scattering elements in said planar guiding portion having spacing selected to scatter light within said waveguide out of said planar guiding portion into a beam directed at said angle.

16. **Claims 45, 47, 48, 51 and 55 are rejected under 35 U.S.C. 102(b) as being anticipated by Li et al. (U.S. Patent 5,657,407 previously relied upon).**

17. Regarding claims 45 a planar guiding portion 11 optically connected to said waveguide, said planar guiding portion having first and second ends and an optical power distribution therein that decreases between said first and second ends; and a plurality of elongate scattering elements

20 having respective scatter cross-sections arranged along at least a portion of said planar guiding portion to couple light having a substantially Gaussian intensity distribution between said planar guiding portion and said optical element, said elongate scattering elements having widths (in the direction of light propagation) which vary in magnitude among at least some of said elongate scattering elements, said widths controlling at least in part said scatter cross-sections of said elongate scattering elements as defined by a relationship between widths and scatter cross-sections, said relationship including at least two widths that provide substantially similar scatter cross-sections, wherein said elongate scattering elements are relatively positioned to provide said substantially Gaussian intensity distribution of said coupled light and said decrease of said optical power distribution in said coupler. See Figure 2.

18. Regarding claim 47, said magnitude of said width changes with position along said planar grating portion so as to provide an optical output substantially matching said Gaussian mode profile of said optical element.

19. Regarding claim 48, said magnitude of said widths both increases and decreases between said first and second ends. See Figure 2.

20. Regarding claim 51, said optical power distribution decreases between said first and second ends of said planar guiding portion substantially in accordance with a relationship as claimed to provide the Gaussian intensity distribution.

21. Regarding claim 55, said waveguide grating coupler couples a substantially planar wave between said waveguide and said optical element, said substantially planar wave oriented at an angle with respect to said planar guiding portion, said elongate scattering elements in said planar

guiding portion having spacing selected to scatter light within said waveguide out of said planar guiding portion into a beam directed at said angle.

Claim Rejections - 35 USC § 103

22. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

23. **Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schultz et al.**

24. Regarding claims 17 and 18, Schultz et al. does not expressly disclose a silicon dioxide layer formed on said silicon wafer, wherein said substrate comprises one or more layers formed on said silicon wafer. IT is well known in the art to provide a waveguide device wherein the substrate comprises a silicon wafer, wherein said substrate further comprises a silicon dioxide layer formed on said silicon wafer, and wherein said substrate further comprises one or more layers of material formed on said silicon wafer to provide low loss waveguides. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the silicon wafer with silicon dioxide layer and at least one or more layers formed on the wafer for the purpose of providing a low loss waveguide as was known in the art.

25. **Claims 46, 49, 50 and 52-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al.**

26. Regarding claim 46, the optical element comprising an optical fiber is not expressly disclosed. However, optical fibers coupled to waveguide grating couplers are well known in the

art. Therefore, an optical fiber would have been obvious for providing efficient light transmission to remote devices.

27. Regarding claims 49 and 50, sidewalls, a channel waveguide, a ridge waveguide, a strip loaded waveguide, and a strip loaded waveguide having a low index transition region is not expressly disclosed. However, any well known planar waveguide, including channel, ridge and strip waveguides, which comprise sidewalls, would have been obvious as Applicant has not disclosed that the particular type of planar waveguides solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with any type of planar waveguide.

28. Regarding claims 52 and 53, Li et al. does not expressly disclose a plot of the magnitudes of said characteristic associated with said widths versus position along said guiding portion containing more than two elongate scattering elements substantially offset from a single exponential or Gaussian function that is fit to said plot, or at least 20 elongate scattering elements. However, the modifications would have been obvious for the purpose of optimizing the grating structure for achieving the preferred Gaussian beam profile.

29. Regarding claim 54, it appears that said magnitude of said characteristic at different positions along said planar grating is selected such that the variation F(z) in scatter cross-sections of the group of elongate scattering elements as a function of longitudinal distance across the group of elongate scattering elements satisfies the following relationship: $G(z) = F(z)\,E(z)$ where G(z) corresponds to said substantially Gaussian mode profile of said optical element, and E(z) corresponds to optical power distribution that decreases between said first and second ends, which results in the Gaussian profile as shown by Li et al.

Allowable Subject Matter

30. Claim 32 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

31. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record does not disclose or fairly suggest said non-monotonically varying relationship between said scatter cross-section and said magnitude to be oscillatory such that it has a plurality of local extrema.

Response to Arguments

32. Applicant's arguments with respect to claims 1-6, 8-12, 15-25, 27, 28, 31-36, 38-42, 45-55 have been considered but are moot in view of the new ground(s) of rejection.

33. Further with regards to claims 45-55, both Schultz et al. and Li et al. disclose varying widths as claimed in the Figures, wherein the width is the dimension of the scattering elements along the propagation direction of light. Although Li et al. may discuss the characteristic in terms of a width-to-pitch ratio, the ratio incorporates a variation in the magnitude of the width of the scattering elements to provide the Gaussian intensity distribution as claimed. It is noted that Figure 2 discloses the magnitude in width changing with position along the planar grating portion, the magnitude both increasing and decreasing, as well as coupling out of a wave at an angle. An exponentially decaying electromagnetic wave along a propagation direction results in decreasing optical power distribution between first and second ends.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sarah Song whose telephone number is 571-272-2359. The examiner can normally be reached on M-Th 7:30am - 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on 571-272-2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Sarah Song
Primary Examiner
Art Unit 2874